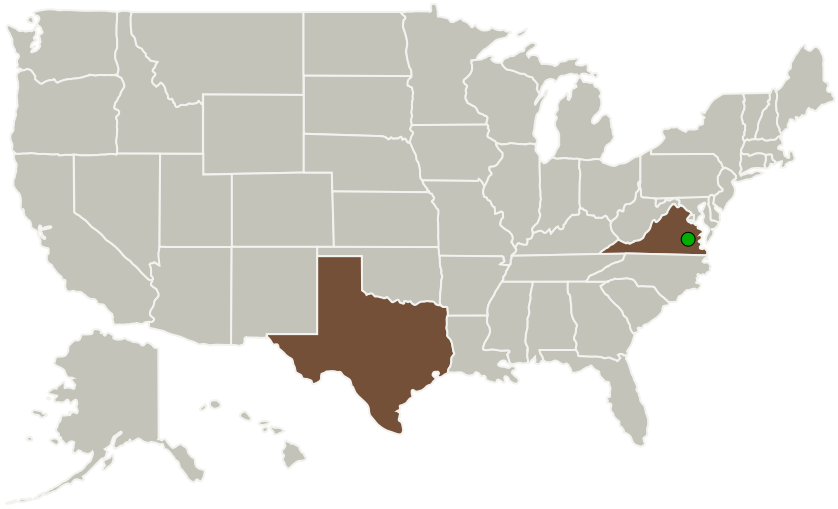
Drastic Improvements in Bonding of Fiber Reinforced Multifunctional Composites, Phase II

Completed Technology Project (2011 - 2013)

Project Introduction

Achievement of a dramatic increase in the bond strength in the adhesive and composite/adhesive interfaces of existing fiber reinforced composite material joints and structures suitable for various NASA applications is the main goal of this project. The proposed technology developed at Integrated Micro Sensors Inc is based on laser-assisted fabrication of Micro Column Arrays (MCA) on the surface of the two materials prior to bonding. There are several advantages of the MCA technology in the drastic improvement of any bond: (i) mechanical strength increases due to interlocking of the adhesive or brazing material between micro columns, (ii) the bond strength increases due to the increase of the specific surface area by more than an order of magnitude, (iii) stability increases due to the inherent elasticity of the micro cones during a deformation, (iv) increase in the bond durability because of the repeated bend contours of the surface preventing hydrothermal failure, (v) wettability of the material surface significantly improves due to the highly developed surface morphology at the micro and submicron level and changes in local chemistry as a result of surface oxidation. Based on the feasibility proven in the Phase I project, this Phase II project will focus on implementation of the proposed technology for newest materials developed up to date and scaling of the proposed technology to large area and complex shape FRP composite structural joints. The investigation of the approach based on using the bond interface electrical properties for joint health monitoring initiated in the Phase I project, will be further developed into viable transducer device concepts.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Integrated Micro Sensors, Inc.	Lead Organization	Industry	Houston, Texas
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Texas	Virginia

Project Transitions

June 2011: Project Start

May 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138814)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Integrated Micro Sensors, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

David Starikov

Co-Investigator:

David Starikov

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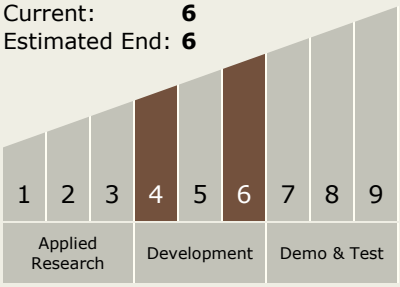
Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System